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ART 34 AMDT

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

10/521831

REC'D: 06 DEC 2004



REC'D: 21 JAN 2005

Applicant's or agent's file reference PA133791/PCT	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/IB 03/02986	International filing date (day/month/year) 28.07.2003	Priority date (day/month/year) 26.07.2002
International Patent Classification (IPC) or both national classification and IPC B29C47/00		
Applicant SASOL WAX (SOUTH AFRICA) (PROPRIETARY) LTD et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.  
☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  
These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:  

I	<input checked="" type="checkbox"/>	Basis of the opinion
II	<input type="checkbox"/>	Priority
III	<input type="checkbox"/>	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	<input type="checkbox"/>	Lack of unity of invention
V	<input checked="" type="checkbox"/>	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	<input type="checkbox"/>	Certain documents cited
VII	<input type="checkbox"/>	Certain defects in the international application
VIII	<input type="checkbox"/>	Certain observations on the international application

Date of submission of the demand 03.12.2003	Date of completion of this report 03.12.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Attalla, G  Telephone No. +49 89 2399-6004 

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/IB 03/02986

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17):*

**Description, Pages**

1, 2, 5-9 as originally filed  
3, 4 filed with telefax on 24.11.2004

**Claims, Numbers**

1-12 filed with telefax on 24.11.2004

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY  
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International application No. **PCT/B 03/02986**

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**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims	1-12
	No: Claims	
Inventive step (IS)	Yes: Claims	1-12
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-12
	No: Claims	

**2. Citations and explanations**

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/IB 03/02986

**Re Item V**

1. Documents D4' (Derwent abstract of JP-A-60189420) and D5 (Derwent abstract of JP-A-60190330) represent the closest state of the art for the present application.
2. D4' and D5 describe a method for producing filaments from a polymer (ultrahigh-molecular-weight-polyethylene) comprising the steps of adding a linear low-molecular weight polymer (paraffin wax) to the polymer to be processed prior to extrusion (both documents disclose extruding or melt-kneading a mixture of polyethylene and wax) and extruding the mixture so formed. The wax is added in an amount above 20 wt.%.
3. The subject matter of claims 1 and 8 differs from the teaching of the above documents in that the linear low-molecular weight polymer (paraffin wax) is added in a quantity from 1 to 4 wt.%. As the skilled person would not find in D4' or D5 or elsewhere in the prior art a hint to reduce the amount of the low-molecular weight polymer in the range disclosed in claims 1 and 8, the subject matter of these claims is considered to meet the requirements of Art. 33 PCT.
4. Claims 2 to 7 and 9 to 12 are dependent upon claim 1 and 8, respectively, and, as such, also meet the requirements of the PCT with respect to novelty and inventive step.

**SUMMARY OF THE INVENTION**

According to the invention there is provided a method of producing polymeric filaments and fibres from a polymer, the method including the steps of:

1. adding from 1% to 4% w/w of a linear low-molecular weight polymer to the polymer to be processed prior to extrusion; and
2. extruding the mixture so formed.

The linear low-molecular weight polymer typically has a chain length of  $C_{30}$  to  $C_{1000}$ , preferably  $C_{80}$  to  $C_{120}$ .

The low -molecular weight polymer is a wax, preferably a wax produced by the Fischer-Tropsch process.

In the Fischer-Tropsch process, synthesis gas (carbon monoxide and hydrogen) is reacted over an iron, cobalt, nickel or ruthenium containing catalyst to produce a mixture of hydrocarbons ranging from methane to waxes and smaller amounts of oxygenates.

In a low temperature Fischer-Tropsch reaction, the reaction takes place in a slurry bed reactor or fixed bed reactor, preferably a slurry bed reactor, at a temperature in the range of  $160^{\circ}\text{C}$  -  $280^{\circ}\text{C}$ , preferably  $210^{\circ}\text{C}$  -  $260^{\circ}\text{C}$ , and a pressure in the range of 18-50 bar, preferably between 20-30 bar, in the presence of a catalyst. The catalyst may include iron, cobalt, nickel or ruthenium. However, a cobalt-based catalyst is preferred for the low temperature reaction. Usually, the cobalt catalyst is supported on an alumina support.

Preferably, the wax of the invention has an initial boiling point of at least  $300^{\circ}\text{C}$  at 101.3kPa.

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The linear low-molecular weight polymer may be melt blended or simply mixed with the polymer to be processed prior to the extrusion step.

The invention also relates to a polymeric filament or fibre containing from 1% to 4% w/w linear low-molecular weight polymer having a chain length from  $C_{30}$  to  $C_{1000}$ , typically from  $C_{80}$  to  $C_{120}$ .

#### DESCRIPTION OF EMBODIMENTS

This invention relates to an improved method for the production of polymeric fibres or filaments in an extrusion process. Typical polymers that may be processed are polypropylene (homopolymer and copolymer), polyethylene (low density, linear low density and high density) as well as blends thereof. According to the invention, a linear low-molecular weight polymer is added to the polymer being processed prior to the extrusion process.

Typical low-molecular weight polymers include linear polymethylene with very little branching (preferably  $<5 \text{ CH}_3/1000\text{C}$ ). Chain lengths of  $C_{30}$  to  $C_{1000}$  are suitable although chain lengths of  $C_{80}$  to  $C_{120}$  are preferred. Particularly suitable linear low-molecular weight polymers are waxes which are produced in the Fischer-Tropsch process. A suitable wax has an initial boiling point of at least  $300^\circ\text{C}$  at 101.3 kPa such as the wax Enhance<sup>TM</sup> which is a proprietary wax of the Applicant.

The amount of low-molecular weight polymer which is added to the polymer to be processed depends on the solubility of the low-molecular weight polymer in the polymer to be processed. Usually the low molecular weight

CLAIMS:

1. A method of extruding a polymer, the method including the steps of:
  1. adding a linear low-molecular weight polymer to the polymer to be processed prior to extrusion; and
  2. extruding the mixture so formed.
2. A method according to claim 1, wherein the method is for producing polymeric filaments and fibres from the polymer.
3. A method according to claim 1, wherein the linear low-molecular weight polymer has a chain length of  $C_{30}$  to  $C_{1000}$ .
4. A method according to claim 3, wherein linear low-molecular weight polymer typically has a chain length of  $C_{80}$  to  $C_{120}$ .
5. A method according to claim 3, wherein the linear low-molecular weight polymer is a wax.
6. A method according to claim 5, wherein the wax produced by the Fischer-Tropsch process.
7. A method according to claim 6, wherein the wax has an initial boiling point of at least  $300^{\circ}\text{C}$  at 101.3kPa.
8. A method according to claim 1, wherein from 0.5% to 25% w/w linear low-molecular weight polymer is added to the polymer to be processed.
9. A method according to claim 8, wherein from 1% to 4% w/w linear low-molecular weight polymer is added to the polymer to be processed.

10. A method according to claim 1, wherein the linear low-molecular weight polymer is melt blended or simply mixed with the polymer to be processed prior to the extrusion step.
11. An extruded polymeric product containing from 0.5% to 25% w/w linear low-molecular weight polymer having a chain length from  $C_{30}$  to  $C_{1000}$ .
12. A product according to claim 11, wherein the linear low-molecular weight polymer has a chain length of  $C_{80}$  to  $C_{120}$ .
13. A product according to claim 11 which is a polymeric filament or fibre.
14. A product according to claim 11, wherein the linear low-molecular weight polymer is a wax.
15. A product according to claim 14, wherein the wax produced by the Fischer-Tropsch process.
16. A product according to claim 15, wherein the wax has an initial boiling point of at least 300°C at 101.3kPa.
17. A product according to claim 11, wherein the linear low-molecular weight polymer comprises 1% to 4% w/w of the product.